VVDED399092US
07/00
Raleigh, NC, USA

Instruction Bulletin | Boletín de instrucciones | Directives d'utilisation

ALTIVAR® 28

Adjustable Speed Drive Controllers

RS-485 Connection Kit VW3A28301U

User's Guide

Variadores de velocidad ajustable

Accesorio de conexión al RS-485, VW3A28301U Manual del usuario

Variateurs de vitesse

Kit de connexion RS-485, VW3A28301U

Guide de l'utilisateur

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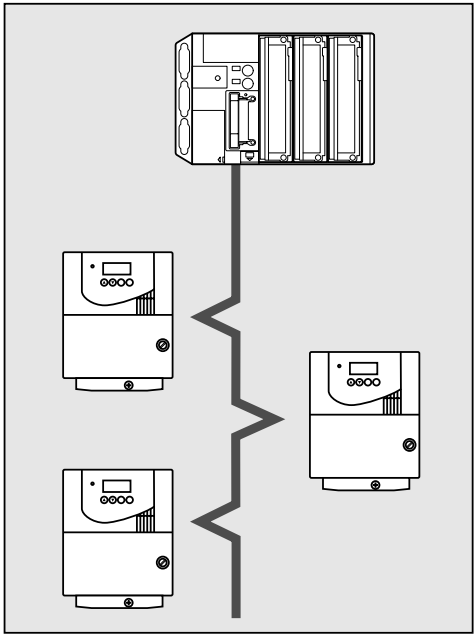

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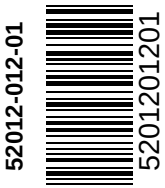

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ENGLISH

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ESPAÑOL

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FRANÇAIS

⚠ DANGER

HAZARDOUS VOLTAGE

- Read and understand this bulletin in its entirety before installing or operating ALTIVAR 28 drive controllers. Installation, adjustment, repair, and maintenance of the drive controllers must be performed by qualified personnel.
- DO NOT short across DC bus capacitors or touch unshielded components or terminal strip screw connections with voltage present.
- Install and close all covers before applying power or starting the drive controller.
- The user is responsible for conforming to all applicable code requirements with respect to grounding all equipment.
- Many parts in this drive controller, including printed wiring boards, operate at line voltage. DO NOT TOUCH. Use only electrically insulated tools.

Before servicing the drive controller:

- Disconnect all power.
- Place a “DO NOT TURN ON” label on the drive controller disconnect.
- Lock disconnect in the open position.

Electrical shock will result in death or serious injury.

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SECTION 1—HARDWARE SETUP

INTRODUCTION

The VW3A28301U communication kit is used to connect an ALTIVAR® 28 (ATV28) drive controller to a MODBUS® network.The communication kit includes a 10 ft (3 m) connection cable equipped with two connectors:

- A 9-pin Sub-D female connector for connection to the bus; and
- An RJ45 connector for connection to the ATV28 drive controller.

The ATV28 drive controller can receive and respond to data messages. This data exchange enables a network to access ATV28 functions such as:

- Remote loading of configuration and adjustment parameters
- Command and control
- Monitoring
- Diagnostics

REVISION LEVEL

This is the first release of this manual. The information contained in it is based on ATV28 firmware version V1.0 or greater.

ADDITIONAL DOCUMENTATION

For more information about ALTIVAR 28 drive controller functions and operation, please refer to the Installation Guide supplied with your controller and user manual VVDED399062US.

INSPECTION

After receiving the VW3A28301U communication kit, ensure that the part number printed on the label is the same as that on the packing slip.

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CABLE INSTALLATION

To install the VW3A28301U communication cable, consult Figure 1 and follow these steps:

1. Remove the plug to access the ATV28 RJ45 connector.
2. Connect the RJ45 cable connector to the ATV28 connector.

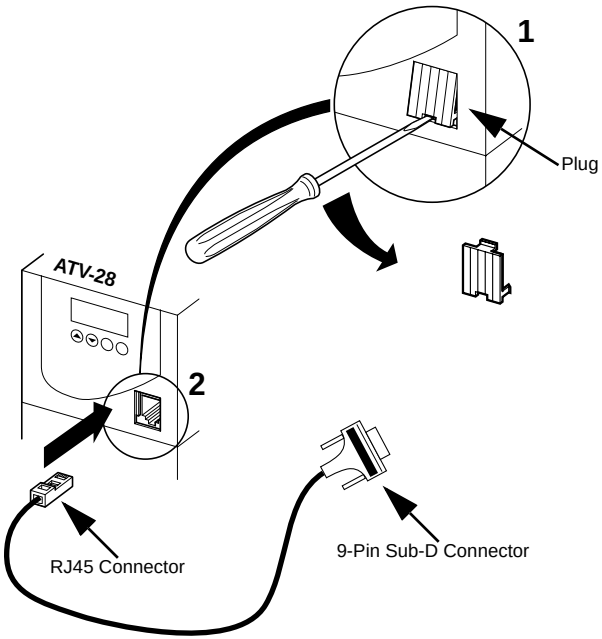

Figure 1: Cable Installation

CONNECTION TO THE BUS

Cable Pin-Out

Figure 2 illustrates the pin-out for using RS-485 type communication.

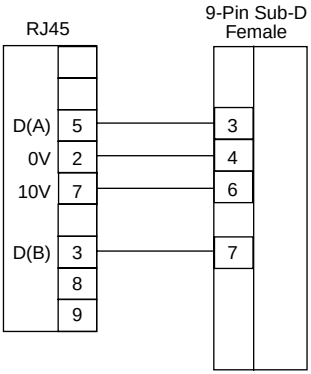

Figure 2: Cable Pin-Out for RS-485 Communication

Wiring Practices for Connection to a Multidrop Bus

When wiring ATV28 drive controllers equipped with communication options to a multidrop bus, follow the wiring practices required by national and local electrical codes in addition to the following:

- Use metallic conduit for all drive controller wiring. Do not run multidrop cable and power wiring in the same conduit.
- Separate metallic conduit carrying power wiring from metallic conduit containing the multidrop cable by at least 3 in. (8 cm).
- Separate non-metallic conduit or cable trays used to carry power wiring from metallic conduit containing multidrop cable by at least 12 in. (30.5 cm).
- Whenever power wiring and multidrop cable cross, the metallic conduit and non-metallic conduit or trays must cross at right angles.
- For the multidrop cable, use shielded cable with one or two pairs of twisted conductors. Use the cable recommended for each multidrop bus system shown. Ground the shield only at one point.

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When connecting the ATV28 controller to the RS-485 bus:

- Make connections only to pins 3, 4, 6, and 7 of the 9-pin Sub-D cable receptacle.
- Use a shielded cable with two pairs of twisted conductor. Cables are available from Square D in lengths of:
  - — 328 ft (100 m) TSX-CSA100
  - — 658 ft (200 m) TSX-CSA200
  - — 1640 ft (500 m) TSX-CSA500
- Connect the communication reference potentials to each other.
- Do not exceed maximum line length of 3280 ft (1000 m).
- Do not exceed maximum tap-off length of 65 ft (20 m).
- Do not connect more than 18 nodes on one bus.
- Terminate both ends of the bus with a 120 Ω resistor in series with a 0.001 µf capacitor as shown in Figure 3.

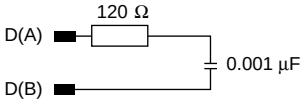

Figure 3: Zt Line Terminator

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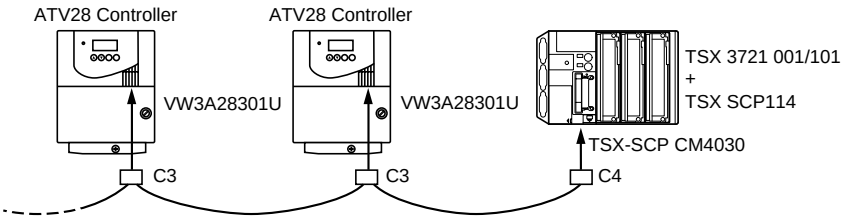
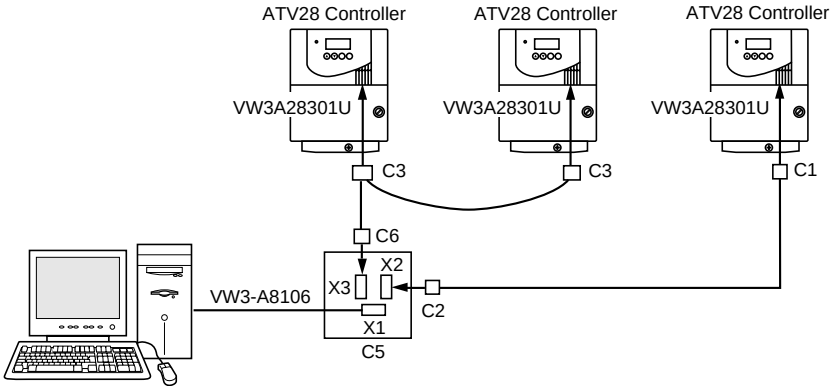
Connection Examples

Figure 4 shows an example of a simplified connection to a PLC. Figure 5 shows an example of a simplified connection of several ATV28 drive controllers to a PC. See Table 1 on page 10 for information on the connection accessories used in the examples.



Note: Physical layer accepting eight drive controllers.

Figure 4: Example of a Simplified Connection to a PLC



Note: Physical layer accepting eight drive controllers.

Figure 5: Example of a Simplified Connection of Several ATV28 Drive Controllers to a PC

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Table 1: Connection Accessories for a Network Using RS-485 Electrical Interface

Accessory	Description
C1	9-pin male connector (Phoenix Contact SUBCON 9/M-SH 2761509) with cabling of pins 3, 4, 6, and 7 (4 conductor shielded cables, 1 mm^2, 16 AWG max.) and 9-pin, SUB-D male/female adapter, as shown below: 
C2	9-pin female connector (Phoenix Contact SUBCON 9/F-SH 2761499) with cabling of pins 3, 4, 6, and 7 (4 conductor shielded cables, 1 mm^2, 16 AWG max.).
C3	Phoenix Contact SUBCON-PLUS M2 2761839 connector with cabling of pins 3, 4, 6, and 7 (4 conductor shielded cables, 1 mm^2, 16 AWG max.) and 9-pin SUB-D male/female adapter.
C4	Tap off junction TSX SCA50 (if applicable) with TSX-SCP CM4030 cable wired in correspondence with the C3 pins. See Figure 6.
C5	Phoenix Contact box, type PSM-PTK 2760623
C6	Phoenix Contact male connector type SUBCON 9/M-SH with wiring for pins 3, 4, and 7 (shielded 4-conductor cable 1 mm^2, 16 AWG max.).
TSX-CSA...	Cables for bus sold in 328 ft (100 m), 658 ft (200 m), and 1640 ft (500 m) lengths.

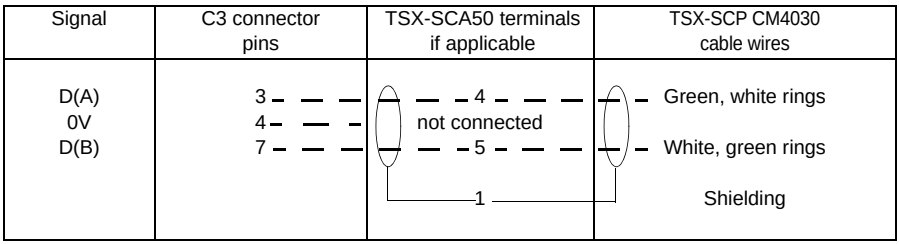

Figure 6: C3 Connector Pins

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SECTION 2—MODBUS PROTOCOL

DESCRIPTION

Exchange Format

The MODBUS protocol has the following exchange format:

- Speed: 9600 or 19200 bps (configured via the bdr parameter in the keypad “I-O” menu)
- Parity: None
- Format: 8 bits plus 1 start bit and 1 stop bit

MODBUS Frames

Figure 7 illustrates the structure of MODBUS RTU frames.

Figure 7: MODBUS RTU Structure

The data is transmitted in binary code. CRC16 is a cyclical redundancy check. See page 17 for more information. The end of the frame is detected by a silence of more than three characters.

ATV28 Address

The ATV28 controller address can range from 1 to 31. To configure the address, use the keypad “I-O” menu of the drive controller or the test and commissioning software (catalog no. VW3A28104).

PRINCIPLE OF COMMUNICATION

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MODBUS protocol is a dialog protocol that creates a hierarchical structure (one master and several slaves). MODBUS protocol enables the master device to interrogate one or more intelligent slave devices. A multidrop link connects the master and slave devices.

Two types of dialog are possible between the master and slave devices:

1. The master device talks to a slave device and waits for its response.
2. The master device talks to all slave devices without waiting for a response (broadcast message).

The slave devices are numbered from 1 to 31. The number 0 is reserved for broadcasting.

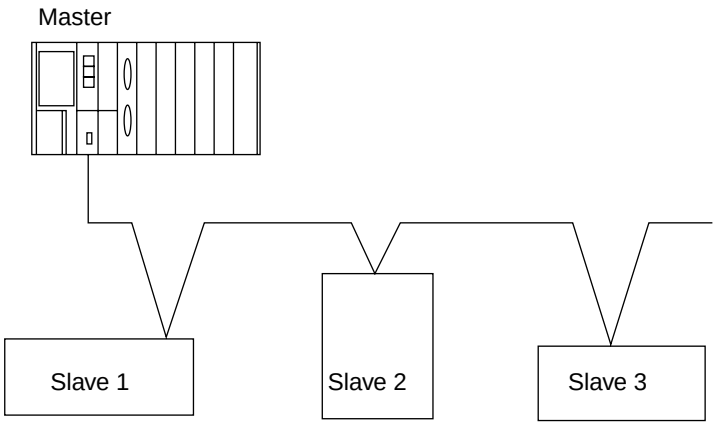

Figure 8: Communication Between Master and Slave Devices

The master device initiates and manages the communication exchanges. The master device repeats the question when there is an incorrect exchange, and declares the interrogated slave absent if it receives no response within a given time. Only one device can transmit on the line at any time. No slave device can send a message unless it is invited to do so. No lateral communication (i.e., slave to slave) is possible. The application software of the master device must therefore be designed to interrogate one slave and send back data received to another slave.

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Master/Slave Relationship

Once a slave device has been interrogated, the master must wait until it receives a response before sending any additional commands. Failure to follow this method causes communication failures.

Accessible Data

MODBUS protocol enables the exchange of data (bits and words) between a master device and several slave devices and checks these exchanges. Only words can be exchanged with an ATV28 controller. In each drive controller there are two types of data objects, input words and output words. Input words are read only. Output words can be read or written. Output words are defined with respect to the master device; they are command, configuration, and adjustment words to the drive controller.

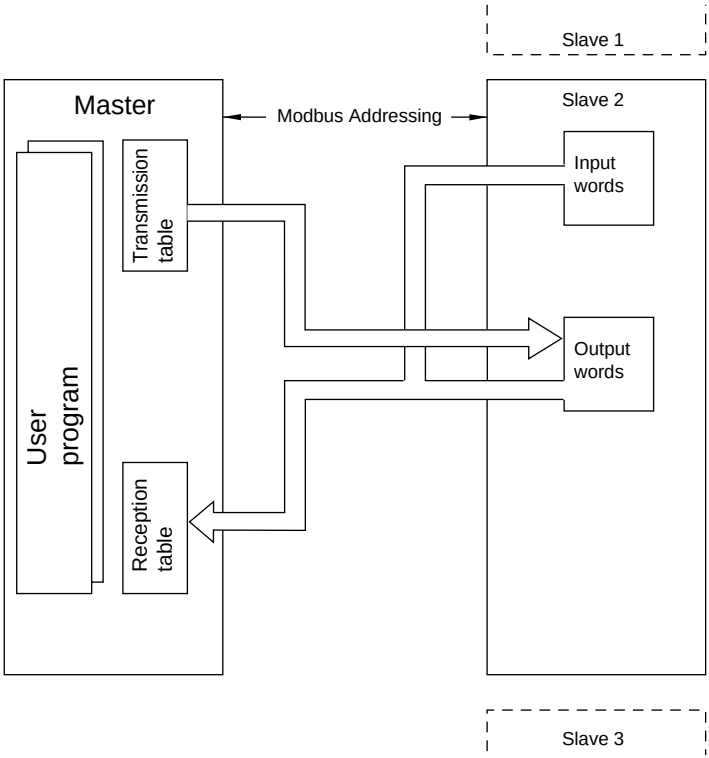

Figure 9: Data Flow

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Exchanges

The master device initiates data exchanges with a slave by supplying it with four types of data:

1. The slave address
2. The function required of the slave
3. The data zone (variable depending on the request)
4. The exchange check

The master device waits for the response from the slave device before transmitting the next message, thus avoiding any conflict on the line.

Control and Supervision

If the slave device receives an invalid message, it transmits an exception response to the master device, and the master device decides whether to repeat the exchange.

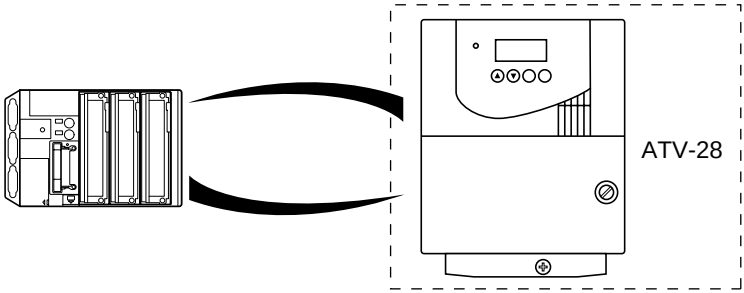

Figure 10: Exchanges Between Master and ATV28 Controller

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MODBUS Functions

MODBUS functions include main functions for data exchange and additional functions for diagnostics. Table 2 shows the functions that the ATV28 communication option manages. The Read and Write functions are defined from the point of view of the master.

Table 2: MODBUS Functions

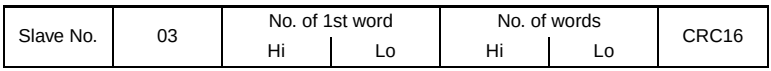
Code	Type of Function	B [1]	Limit	Description
03	Read N output words		7 max.	Reads words that the master can write and read in the slave.
06	Write one output word	B	N/A	Writes a 16 bit output word.
16	Write N output words	B	7 max.	Writes words that the master can write and read in the slave.

1. Functions marked “B” can be broadcast. The message transmitted by the master must specify slave number=0. A response message is never returned.

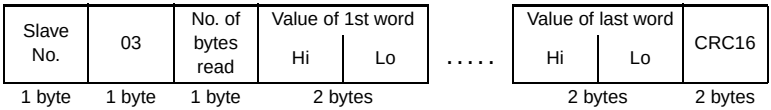
The following sections provide details of the data frames used for each of the MODBUS functions.

Function 03: Read N Output Words (RTU Format)

Query:



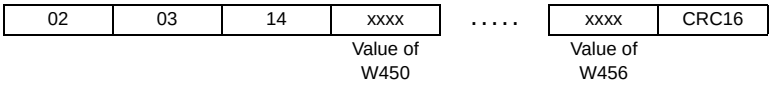
Response:



For example, to read words W450–W456 of slave 2 (supervision parameters), send the following data frame:

02	03	01C2	000A	CRC16

The response to this query is:



Function 06: Write an Output Word (RTU Format)

NOTE: The response is always the same as the query (echo).

Query:

Slave No.	06	Word no.		Word values		CRC16
		PF	PI	PF	PI	
1 byte	1 byte	2 bytes		2 bytes		2 bytes

Response:

Slave No.	06	Word no.		Word values		CRC16
		PF	PI	PF	PI	
1 byte	1 byte	2 bytes		2 bytes		2 bytes

Function 16: Write N Output Words (RTU Format)

Query:

Slave No.	10	No. of 1st word		No. of words	No. of bytes	Value of 1st word		....	CRC16
		Hi	Lo			Hi	Lo		
1 byte	1 byte	2 bytes		2 bytes	1 byte	2 bytes			2 bytes

Response:

Slave No.	10	No. of 1st word		No. of words		CRC16
		Hi	Lo	Hi	Lo	
1 byte	1 byte	2 bytes		2 bytes		2 bytes

For example, to write values 15 and 400 in words W400 and W401 of slave 2, you would send the following data frame:

02	10	0190	0002	04	000F	0190	CRC16

The response to this message would be:

02	10	0190	0002	CRC16

Exception Responses (RTU Format)

A slave returns an exception response when it is unable to perform the request addressed to it. The format of an exception response is as follows:

Slave No.	Response Code	Error Code	CRC16
1 byte	1 byte	1 byte	2 bytes

Response code	Function code of the request + H'80' (the most significant bit is set to 1)
Error Code	1 = The slave does not recognize the function requested.
	2 = The bit and word numbers (addresses) indicated in the request do not exist in the slave.
	3 = The bit and word values indicated in the request are not accessible in the slave.
	4 = The slave has started to execute the request but cannot continue to process it completely.

CRC16 Calculation (RTU Format)

The CRC16 is calculated on all the bytes of the message by applying the following method ('XOR' indicates Exclusive-Or):

- Initialize the CRC (16-bit register) to H'FFFF.
- Enter the first to the last byte of the message:

  CRC XOR <byte> → CRC
  ENTER 8 times
  Move the CRC one bit to the right
  If the output bit = 1, enter CRC XOR H'A001 → CRC
  END enter

The low order bytes of the CRC obtained are transmitted first, then the high order ones.

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MSTR BLOCK

A network of 28 drive controllers using RS-485 can be created using the MSTR block and a MODBUS PLUS to MODBUS converter.This section discusses read and write MSTR instruction blocks. For additional information on MODBUS instructions, refer to the *Modicon Ladder Logic Block Library User Guide, 840 USE 10100*.

Overview of MSTR Block

PLCs that support MODBUS PLUS communications have a special MSTR (master) instruction allowing nodes of the network to initiate message transactions. The MSTR function allows you to initiate one of nine possible network communications operations over the MODBUS PLUS network. Each operation is designated by a code (see Table 3).

Table 3: MSTR Operation Codes

MSTR Operation	Code	MSTR Operation	Code
Write Data	1	Read Global Database	6
Read Data	2	Get Remote Statistics	7
Get Local Statistics	3	Clear Remote Statistics	8
Write Global Database	5	Peer Cop Status	9

MSTR Block Structure

Inputs

MSTR has two control points (see Figure 11 on page 19):

- Top node input—enables the instruction when it is ON.
- Middle node input—terminates the active operation when it is ON.

Outputs

MSTR can produce three possible outputs (see Figure 11):

- Top node output—echoes the state of the top input (goes ON while the instruction is active).
- Middle node output—echoes the state of the middle input and goes ON if the MSTR operation is terminated prior to completion.
- Bottom node output—goes ON when an MSTR operation is completed successfully.

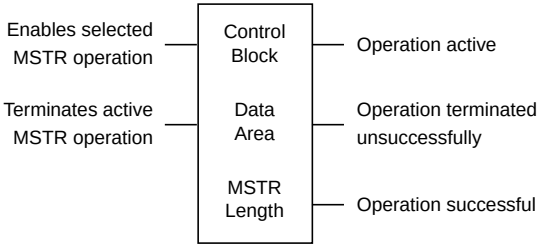

Figure 11: MSTR Block Structure

Top Node Content

The 4x register entered in the top node is the first of nine contiguous holding registers that comprise the control block (see Table 4).

Table 4: Control Block Holding Registers

Register	Content
Displayed	Identifies one of the nine MSTR operations
1st implied	Displays error status
2nd implied	Displays length
3rd implied	Displays MSTR operation-dependent information
4th implied	Routing 1 register, used to designate the address of the destination node for a network message transaction.
5th implied	Routing 2 register
6th implied	Routing 3 register
7th implied	Routing 4 register
8th implied	Routing 5 register

Middle Node Content

The 4x register entered in the middle node is the first in a group of contiguous holding registers that comprise the data area. For operations that provide the communication processor with data—such as a write operation—the data area is the source of the data. For operations that acquire data from the communication processor—such as a read operation—the data area is the destination for the data.

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Bottom Node Content

The integer value entered in the bottom node specifies the length—the maximum number of registers—in the data area. Although the typical MODBUS length can range from 1 to 100, the ATV28 drive controller range is 1 to 60.

Read and Write MSTR Operations

An MSTR write operation transfers data from a controlling device to the drive controller. An MSTR read operation transfers data from the drive controller to a controlling device on the network.

The registers in the MSTR control block (the top node) contain the following information in a read or write operation (see Table 5).

Table 5: Control Block Registers—Read and Write Operations

Register	Function	Content
Displayed	Operation type	1 = Write; 2 = Read
1st implied	Error status	Displays a hex value indicating MSTR error, when relevant
2nd implied	Length	Write = # of registers to be sent to drive controller Read = # of registers to be read from drive controller
3rd implied	Drive controller data area	Specifies starting register in the drive controller to be read from or written to
4th … 8th implied	Routing 1 … 5	Designates 1st … 5th routing path addresses, respectively; last non-zero byte in routing path is the transaction device.

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XMIT FUNCTION BLOCK

The XMIT function block allows you to make a MODBUS port a master on various Modicon PLCs. See Figure 12 for an example of a XMIT function block on a ProWork Nxt screen. Consult the appropriate Modicon documentation to ensure that your configuration and options allow the MODBUS port to be modified.

NOTE: The MODBUS/JBUS/UNITELWAY communication option card uses a two-wire RS-485 electrical interface. If the port you are using on the PLC is an RS-232 interface that does not support RS-485, you must use an RS-232 to RS-485 converter that is Auto enabled (sometimes called Data enabled). Remember that some ports are only RS-422 and require an RS-422 to RS-485 converter.

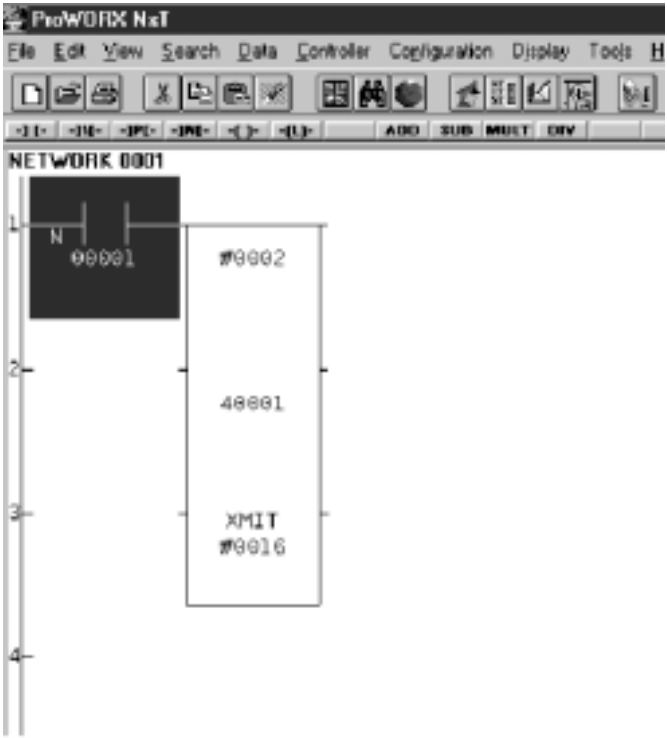

Figure 12: XMIT Function Block

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The XMIT instruction block (shown in Figure 13) lets you transmit data directly out of the PLC. You can set the parity, stop bits, and pulse or tone dialing (among other values) just like a modem.

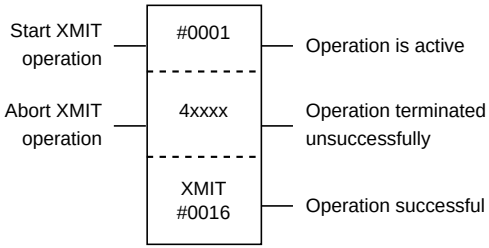


Figure 13: XMIT Instruction Block

- **#0001**: The top node must contain the constant #0001.
- **4xxxx**: The 4x register in the middle node addresses the first in a group of 16 contiguous registers that comprise the control block.
- **#0016**: The bottom node must contain the constant #0016. This is the number of registers in the control block pointed to by the middle node.
- **Start XMIT operation**: Begins an XMIT operation. Your logic should keep this on until the operation completes successfully or an error occurs.
- **Abort XMIT operation**: Aborts an active XMIT operation, forcing the port to slave mode. The abort code 121 is placed in the fault status register. The port remains closed as long as this input is on.
- **Operation is active**: Passes power while an XMIT operation is in progress.
- **Operation terminated unsuccessfully**: Passes power when XMIT has detected an error or when an XMIT operation was aborted.
- **Operation successful**: Passes power when an XMIT operation has successfully completed.

NOTE: Do not modify the address in the 4xxxx middle node or delete XMIT from the program while the block is active. This locks up the communication port, preventing further communication.

The XMIT instruction block does not operate correctly if:

- The NSUP and XMIT loadable are not installed.
- The NSUP loadable is installed after the XMIT loadable.
- The NSUP and XMIT loadables are installed in a Quantum PLC with an out-of-date executive (older than version 2.10 or 2.12).

Registers in the XMIT control block are as follows:

Table 6: XMIT Control Block Registers

Register	Function	Range
4x	Revision Number	Read only. Decimal.
4x+1	Fault Status	Read only.
4x+2	Not used by XMIT	Available for customer use.
4x+3	Data Rate	50, 75, 110, 134, 150, 300, 600, 1200, 2400, 9600, or 19200 bits per second.
4x+4	Data Bits	7, 8
4x+5	Parity	0, 1, 2
4x+6	Stop Bits	0, 1, 2
4x+7	Not used by XMIT	Available for customer use.
4x+8	Command Word	16-digit binary number.
4x+9	Pointer to Message Table	Values are limited by the range of 4x registers configured.
4x+10	Length of Message	0–512
4x+11	Response Time-out	0–65535 milliseconds
4x+12	Retry Limit	0–65535 milliseconds
4x+13	Start of Transmission Delay	0–65535 milliseconds
4x+14	End of Transmission Delay	0–65535 milliseconds
4x+15	Current Retry	Read only.

The MSTR and XMIT functions have the ability to violate the MODBUS Master/Slave architecture, as does a custom-written MODBUS driver.

A communication request must not be issued before the previous request has been completed. Otherwise, the communication requests can cause the drive controller's memory to overflow, resulting in a communication fault.

NOTES

SECTION 3—CONTROLLING AND MONITORING THE ATV28 DRIVE CONTROLLER

DRIVECOM STANDARD ADAPTED TO THE ATV28 DRIVE CONTROLLER

The ATV28 control process using the serial link conforms to the DRIVECOM standard state chart. Figure 16 illustrates the DRIVECOM standard adapted to the characteristics of the ATV28 drive controller to facilitate programming. Each state represents an aspect of the internal behavior of the drive controller.

The drive controller status can be modified by sending control word CMD (word W400), a hexadecimal value, or by the occurrence of an event such as a drive controller lock after a fault. The drive controller status is indicated by the value of the status register (ETA).

When a fault occurs, ETA (word 458) is set to xxx8h. To clear the fault, set CMD (word 400) to a value of 80h. The drive controller is now on and locked, with ETA set to a value of xx40h. To enter “Standby Status”, write “0006h” to CMD. ETA now has a value of xx21h. Next, enter the “Ready” state by writing “0007h” to CMD. ETA now has a value of xx23h. At this point, the motor can be commanded to rotate forward (by writing “000Fh” to CMD) or reverse (by writing “080Fh” to CMD).

ENGLISH

Communication Fault Detection

⚠ WARNING

LOSS OF CONTROL

Provide some method of controlling the drive controller until communication is established. Provide alternate control paths (Start, Stop, and Speed):

- When disabling communication loss detection.
- When motor control is required while a communication fault exists.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Setting CMI (word W402) bit 14 to 1 disables communication loss detection. As a result, loss of communication does not cause the drive controller to generate a fault. The drive controller continues its present operation. Alternate control paths must be provided for starting, stopping, and controlling the motor. No control commands are received during loss of communication. This function is intended for use during troubleshooting and start-up.

Maintaining Communication

After communication has been established, the drive controller must receive a communication request (read or write) every seven seconds or the drive controller will generate a communication fault. **A communication request must not be issued before the previous request has been completed. Otherwise, the communication requests can cause the drive controller's memory to overflow, resulting in a communication fault.**

If a communication fault is generated, the fault prevents starting the controlled motor until the fault is cleared. Recycling the power clears the fault.

ATV28 CONTROL MODES

Hand/Off/Auto (HOA)

When the ATV28 drive controller is powered up, it defaults to local (hand) control. See the discussion of local and remote control on page 28. After the drive controller recovers from a power up sequence (including such unplanned events as an AC line power disturbance), it immediately responds to local controls that may be active before the MODBUS

communication link has initialized and assumed control of the drive controller. **This results in unintended equipment operation. It is therefore required that all local (hand) run and start commands to the drive controller be removed when the system is in the remote (auto) mode.**

While it is possible to stop the drive controller in remote (auto) mode by activating one of the local stop commands (such as the keypad display stop button), commands sent over the MODBUS link can restart the drive controller if the drive controller is not in a forced local condition. See the discussion of forced local on 28. **It is therefore necessary to put the drive controller into the forced local mode when the control switch is in the hand or off position.**

⚠ WARNING

LOSS OF CONTROL

The user must provide a Hand/Off/Auto switch with the following functionality:

- In Hand mode, forced local must be enabled.
- In Off mode, all run terminal inputs must be disabled via open circuit and forced local must be enabled.
- In Auto mode, the run terminal inputs must be disabled via open circuit and forced local must be disabled.

Failure to follow these instructions can result in death or serious injury.

See Figures 14 and 15 for assistance in designing Hand/Off/Auto control.

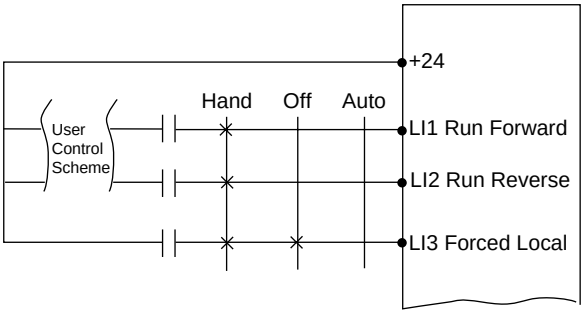


Figure 14: Example 2-Wire Control

NOTE: Removal of local Run Forward or Run Reverse commands while the HOA switch is in the Auto position will not stop the drive controller.

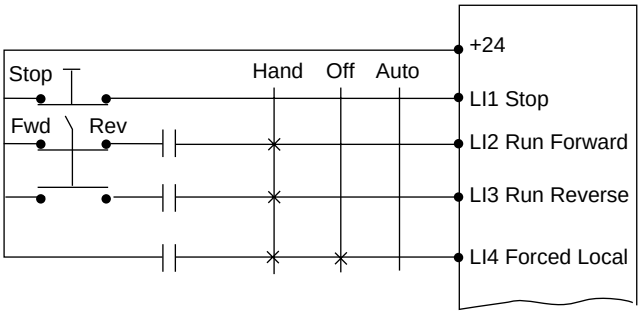


Figure 15: Example 3-Wire Control

Local and Remote

The ATV28 drive controller can be commanded in local and remote control modes.

Local (Hand) Control

- The drive is controlled by operators such as push buttons, switches, and a speed potentiometer that are wired to the drive controller terminal block or
- The drive is controlled by the digital keypad display buttons.

See the ATV28 User's Guide, VVDED399062US, for more details on how to select between the two modes of local control.

Remote (Auto) Control

- The drive is controlled by the MODBUS serial link.

The speed reference and the start/stop control cannot come from separate sources.

Forced Local

Switching between local and remote control is achieved by a switch wired to a logic input on the controller terminal block as illustrated in Figures 14 (page 27) and 15. The logic input must be assigned to the function "Forced Local."

When the logic input assigned to forced local is active (high), all control of the drive is assigned to the selected local (hand) control mode. In this case, command requests by the MODBUS network are refused. Command parameters can be monitored. All other parameters may be read/write accessed.

⚠ WARNING

UNINTENDED EQUIPMENT ACTION

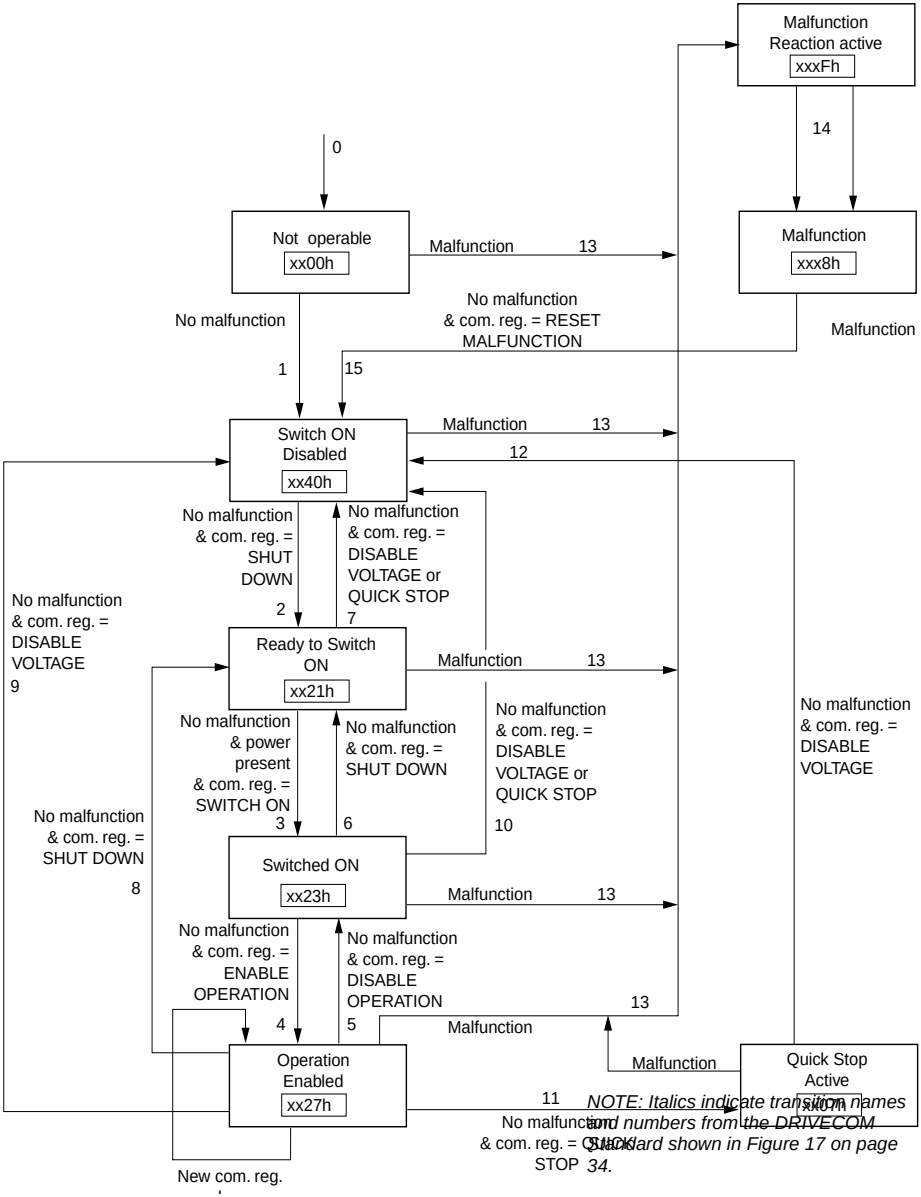
When in forced local mode, all commands from the communication ports are ignored.

Failure to consider the implications of unanticipated operation can result in death, serious injury, or equipment damage.

When the logic input is not active (low), all control of the drive is transferred to the MODBUS network. The only local (hand) controls that are still monitored by the drive controller include the logic input assigned to Forced Local and any input assigned to a drive stop function. Examples include the stop button on the keypad display, logic input 1 (LI1)—which is assigned to the function STOP if the ATV28 drive controller is configured for 3-wire control—and any logic input assigned to the functions freewheel stop, DC injection braking, and fast stop.

See the ATV28 Drive Controller User's Guide, VVDED399062US (latest revision), for more details.

ENGLISH



NOTE: Italics indicate transition names and numbers from the DRIVECOM Standard shown in Figure 17 on page 34.

Figure 16: DRIVECOM as Implemented on the ATV28 Drive Controller

Table 7: STOP Requests

Type of Stop	Corresponding DRIVECOM state	To restore control of the ATV28 drive controller using the fieldbus:
Freewheel stop	ATV28 powered up	1. Set the terminal strip logic input assigned to the freewheel stop function to 1. 2. Perform the transitions required to return the drive controller to “Run” status.
Fast stop	ATV28 running	Set the terminal strip logic input assigned to the fast stop function to 1.
DC injection stop	ATV28 running	Set the terminal strip logic input assigned to the DC injection stop function to 0.
Stop via keypad STOP key	ATV28 powered up	1. Release the Stop key. 2. Perform the transitions required to return the drive controller to “Run” status.
3-wire control stop via logic input stop (LI1)	ATV28 powered up	1. Set the logic input assigned to STOP to 1. 2. Perform the transitions required to return the drive controller to “Run” status.

Communication Principle

The ATV28 drive controller can be connected to only one fieldbus, and this one fieldbus controls the ATV28.

The fieldbus connected to the communication port always takes priority. However, when the MODBUS master is not controlling the ATV28, the fieldbus may send configuration words (provided the motor is stopped), adjustments, and read display words.

The bus controlling the drive controller can relinquish control by setting bits 8 and 15 of the control word 400 (CMD) to 1.

For further information, refer to the communication principles described on page 13.

ENGLISH

SUMMARY OF DRIVECOM STANDARD

Table 8: Control Register (CMD) Bit Definition [1]

bit 0	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7
Switch ON	Disable voltage	Quick stop	Enable operation	optional	optional	optional	Reset malfunction
Switch to drive controller ready	Return to ATV28 powered up status	Fast stop	Run/stop	reserved	reserved	reserved	Reset fault acknowledged

bit 8	bit 9	bit 10	bit 11	bit 12	bit 13	bit 14	bit 15
reserved	reserved	reserved	specific to manufacturer	specific to manufacturer	specific to manufacturer	specific to manufacturer	specific to manufacturer
reserved	reserved	reserved	Reverse motor direction	reserved	Stop by injection	Fast stop	see page 35

[1] The grey boxes correspond to the DRIVECOM standard. The white boxes correspond to the adaptation of the ATV28 controller to this standard. See also Table 20 on page 46.

Table 9: Control Register Commands

DRIVECOM command shown in Figure 17 on page 34	bit 7	bit 3	bit 2	bit 1	bit 0	transition in DRIVECOM diagram (see Figure 16 on page 30 or Figure 17 on page 34)	sample values of the control register
initial/default state Switch ON disabled	1	0	0	0	0	1	00F0H
Shut Down	X	X	1	1	0	2, 6, 8	0006h
Switch ON	X	X	1	1	1	3	0007h
Disable Voltage	X	X	X	0	X	7, 9, 10, 12	0000h
Quick Stop	X	X	0	1	X	11	000Bh
Disable Operation	X	0	1	1	1	5	0007h
Enable Operation	X	1	1	1	1	4	000Fh
Reset Malfunction	0>1	X	X	X	X	15	0080h

X: State is not significant

0>1: Rising edge (switch from 0 to 1)

Table 10: Status Register (ETA) Bit Definition [1]

bit 0	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7
Ready to switch ON	Switched ON	Operation enabled	Malfunction	Voltage disabled	Quick stop	Switch ON disabled	Warning
not ready/ ready for start-up	drive controller not ready/ ready	stop/run	no malfunction	power on/off	fast stop in progress	drive controller locked	Alarm

bit 8	bit 9	bit 10	bit 11	bit 12	bit 13	bit 14	bit 15
Message	Remote	Reference reached	Limit value	reserved	reserved	specific to manufacturer	specific to manufacturer
reserved	local/ remote	reference reached	min. or max. value reached	reserved	reserved	stop via STOP key	direction of rotation forward/reverse

[1] Grey boxes correspond to the DRIVECOM standard. White boxes correspond to the adaptation of the ATV28 controller to this standard. See also W458 on page 49.

Table 11: Status Register (ETA) States

State in DRIVECOM Standard shown in Figure 17 on page 34	bit 6	bit 5	bit 3	bit 2	bit 1	bit 0
Not ready to switch ON	0	X	0	0	0	0
Switch ON disabled	1	X	0	0	0	0
Ready to switch ON	0	1	0	0	0	1
Switch ON	0	1	0	0	1	1
Operation enabled	0	1	0	1	1	1
Malfunction	0	X	1	0	0	0
Malfunction Reset Active	0	X	1	1	1	1
Quick stop active	0	0	0	1	1	1

X: State is not significant

Bit 4 is not significant and is therefore not shown in the table.

Table 12: Description of Other Status Register (ETA) Bits

bit 4	Supply voltage	= 1 Power is absent
bit 7	Warning	= 1 A standard or user-specific warning is present
bit 8	Message	= 1 A message (event) is present (optional)
bit 9	Remote	= 1 If the parameters can be modified via bus outside local forcing
bit 10	Reference reached	= 1 If the reference value is reached
bit 11	Limit value	= 1 If a limit value is reached (min-max speed)

ENGLISH

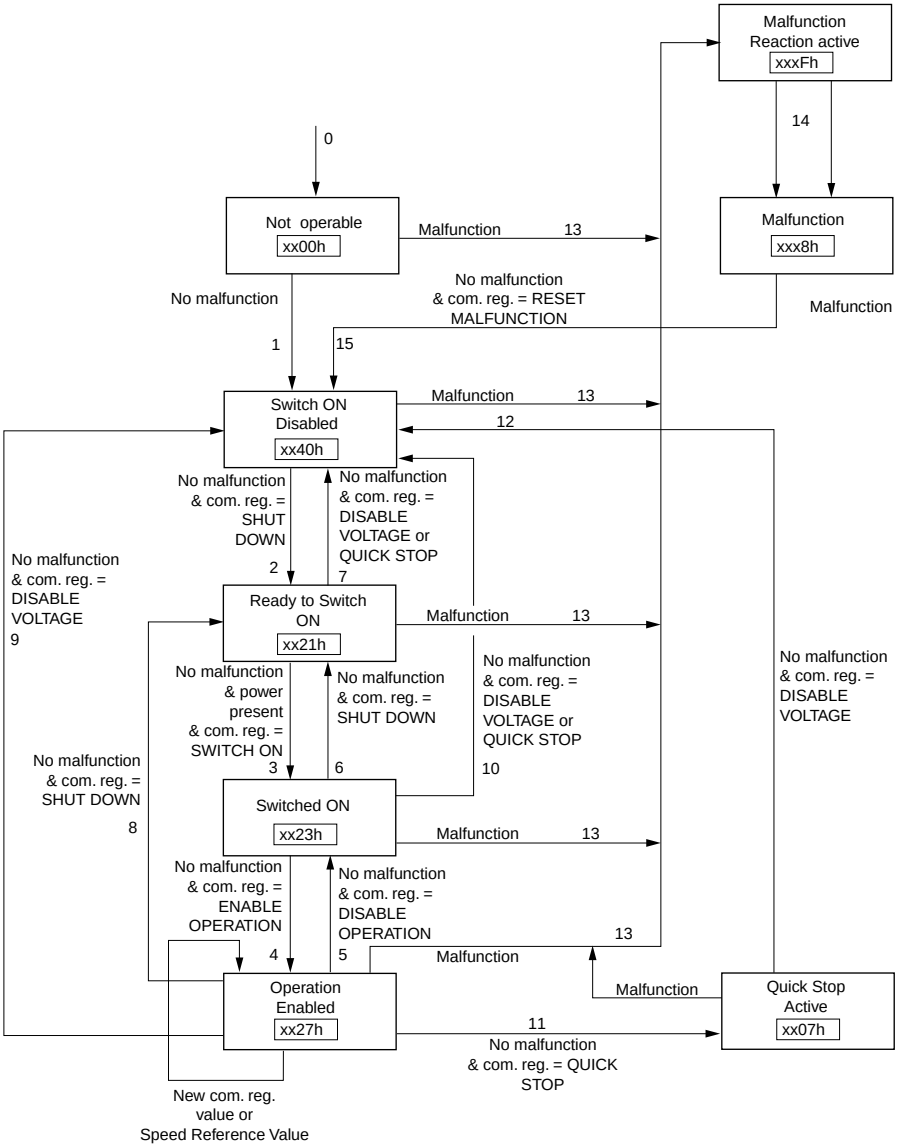


Figure 17: DRIVECOM Standard

ALTERNATIVE TO DRIVECOM STATE RING

The drivecom state ring can be bypassed by setting the following bits in W400 CMD:

- By setting bits 15, 3, and 1 to a “1” (800A Hex, 32778 Decimal), the drive controller runs at the frequency reference.
- By setting bits 15, 12, 3, and 1 to a “1” (900A Hex, 36874 Decimal), the drive controller stops the motor on the programmed deceleration ramp.
- By setting bits 15, 13, 3, and 1 to a “1” (A00A Hex, 40970 Decimal), the drive controller stops the motor using the DC injection settings.
- By setting bits 15, 14, 3, and 1 to a “1” C00A Hex, 49162 Decimal), the drive controller fast stops using the Fast Stop settings.
- By setting bits 15, 11, 3, and 1 to a “1” (880A Hex, 34826 Decimal), the drive controller runs in the reverse direction at the frequency reference.

NOTES

SECTION 4— PARAMETER DESCRIPTIONS

⚠ WARNING

UNINTENDED EQUIPMENT ACTION

- Writing to registers designated as reserved can cause unintended equipment operation.
- DO NOT write data to registers unless you completely understand the function to be performed. Consult the user instruction bulletin for additional details.
- Bit 0 is the right-most (least significant) bit. Bit 15 is the left-most (most significant) bit.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Table 13 shows register mapping as viewed in MODICON programming software (MODSOFT or CONCEPT) reference data.

Table 13: ATV28 and MODICON™ PLC Register Mapping

ATV28 Drive Controller	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
QUANTUM™ PLC [1]	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

NOTE: All registers are integers. All decimal places in units are implied.

[1] For MOMENTUM™ PLCs, consult the MODICON MOMENTUM user's manual.

ACCESSING PARAMETERS: AN OVERVIEW

ENGLISH

The RS-485 link identifies ALTIVAR 28 drive controllers as a series of holding registers. The tables in this section describe ATV28 registers and their corresponding RS-485 link addresses (words). The registers are grouped by function and are in numerical order.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are Emergency Stop and Overtravel Stop. Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links.Consideration must be given to the implications of unanticipated transmission delays or failures of the link.

Failure to follow these instructions can result in death, serious injury, or equipment damage.[1]

1. For additional information, refer to NEMA ICS 1.1 (latest revision), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS7.1 (latest revision), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.”

Depending on the MODBUS driver, you may need to add 1 to the register address to obtain the correct address. To determine if this is necessary, read word 454 with the motor stopped. If you do not read the line voltage in Word 454, 1 must be added to the register address to obtain the correct address. Repeat this step to verify the correct address.

You must monitor status registers 458, 459, and 460 to determine the correct state. A logic input used to force a freewheel stop does not affect bits in the CMD word 400.

INDEX OF PARAMETERS

NOTE: To look up registers by code (e.g., CIC, TCC), refer to the index at the end of this manual.

Table 14: Index of Parameters by Address Range

ENGLISH

CONFIGURATION PARAMETERS (READ AND WRITE)

General Configuration Parameters

These parameters can only be adjusted with the motor stopped, except Sds and SFr, which can be adjusted with the motor running.

Table 15: General Configuration Parameters

Word	Code	Units	Description	Possible Values or Range
W2	COd	–	Access Code.	0 to 9999
W4	CrL	0.1 mA	Minimum reference of input AI2.	0 to 200
W5	CrH	0.1 mA	Maximum reference of input AI2.	40 to 200
W6	tCC	–	2-wire/3-wire control via terminals. Modification of this parameter reassigns the I/O.	0 = 2C (2-wire control) 1 = 3C (3-wire control) 2 = OPt (local control option is present, so writing is impossible)
W10	Add	–	Address of the drive controller via the standard serial link.	1 to 31
W16	bdr	–	Serial link transmission speed. This parameter is not actually modified until the drive controller is switched off and then on again.	7 = 9600 bps 8 = 19200 bps
W40	bFr	–	Motor configuration.	0 = 50 Hz 1 = 60 Hz
W41	SdS	–	Scale factor of SPd parameter (speed display). Can be adjusted while operating.	1 to 200
W42	AOt	–	Configuration of analog output.	0 = 0 to 20 mA 1 = 4 to 20 mA
W51	SFr	0.1 kHz	Switching frequency (can be adjusted while operating).	20 to 150 (2 to 15 kHz)
W52	tFr	0.1 Hz	Maximum frequency.	400 to 4000
W53	FrS	0.1 Hz	Nominal motor frequency.	400 to 4000
W55	UnS	1 V	Nominal motor voltage.	ATV28•••M2: 200 to 240 ATV28•••N4: 380 to 500
W59	tUn	–	Autotune.	0 = nO (Autotune is not performed and the value from the table is used instead; if written, returns to the value from the table) 1 = donE (Autotune is performed; if written, parameters set by previous autotuning in use) 2 = YES (Autotune command)
W60	nrd	–	Motor noise reduction.	0 = nO 1 = YES

Table 15: General Configuration Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W61	UFt		Voltage frequency ratio (V/Hz ratio)	0 = L (Constant torque for parallel or special motors) 1 = P (Variable torque) 2 = n (Sensorless flux vector control for applications with constant torque) 3 = nLd (Energy-saving for applications with variable torque)
W64	brA	–	Deceleration ramp adaptation (avoids switch to obF fault)	0 = nO 1 = YES
W65	Frt	0.1 Hz	Ramp switching threshold (switch to AC2 and DE2 if output frequency is greater than FrT and FrT is not equal to 0). This may be adjusted while operating. Note that if a logic input is assigned to the ramp switching threshold function (rP2), this parameter is not accessible.	0 to HSP

I/O Configuration Parameters

These parameters can only be adjusted with the motor stopped.

Table 16: I/O Configuration Parameters

Word	Code	Units	Description	Possible Values or Range
W100	LI1		Assignment of logic input LI1 (read only).	0 = Not assigned (local control option present, ICC = OPt) 1 = Stop (if tCC = 3C) 2 = Forward operation (if tCC = 2C)
W101	LI2		Assignment of logic input LI2 (read only).	0 = nO (Not assigned) 2 = For (Forward operation, if tCC = 3C) 3 = rrS (Reverse operation) 4 = rP2 (Ramp switching) 5 = JOG (Jog operation) 8 = PS2 (Two preset speeds) 9 = PS4 (Four preset speeds) 10 = PS8 (Eight preset speeds) 11 = rFC (Reference switching) 12 = nSt (Freewheel stop) 13 = dCI (Injection stop) 14 = FSt (Fast stop) 17 = FLO (Forced local) 18 = rSt (Clear faults)

ENGLISH

Table 16: I/O Configuration Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W102	LI3		Assignment of logic input LI3.	0 = nO (Not assigned) 3 = rrS (Reverse operation) 4 = rP2 (Ramp switching) 5 = JOG (Jog operation) 8 = PS2 (Two preset speeds) 9 = PS4 (Four preset speeds) 10 = PS8 (Eight preset speeds) 11 = rFC (Reference switching) 12 = nSt (Freewheel stop) 13 = dCI (Injection stop) 14 = FSt (Fast stop) 17 = FLO (Forced local) 18 = rSt (Clear faults)
W103	LI4		Assignment of logic input LI4.	0 = nO (Not assigned) 3 = rrS (Reverse operation) 4 = rP2 (Ramp switching) 5 = JOG (Jog operation) 8 = PS2 (Two preset speeds) 9 = PS4 (Four preset speeds) 10 = PS8 (Eight preset speeds) 11 = rFC (Reference switching) 12 = nSt (Freewheel stop) 13 = dCI (Injection stop) 14 = FSt (Fast stop) 17 = FLO (Forced local) 18 = rSt (Clear faults)
W107	AI2		Assignment of analog input AIC/AI2.	0 = nO (Not assigned) 3 = SAI (Summing reference) 4 = PIA (PI feedback — PI regulator with AI1 reference) 8 = PII (PI feedback — PI regulator with internal reference; reference set by rPI [W440])
W110	r2		Assignment of relay R2.	0 = nO (Not assigned) 4 = FtA (Frequency threshold [Ftd] reached) 6 = CtA (Current threshold [Ctd] reached) 7 = SrA (Frequency reference reached) 8 = tSA (Thermal threshold [ttd] reached)
W112	AO		Assignment of analog output AO.	0 = nO (Not assigned) 1 = OCr (Motor current) 2 = rFr (Motor frequency) 4 = OLO (Motor torque) 5 = OPr (Motor rating)

ENGLISH

Fault Configuration Parameters

These parameters can be adjusted with the motor stopped or running.

Table 17: Fault Configuration Parameters

Word	Code	Units	Description	Possible Values or Range
W150	Atr		Automatic restart.	0 = nO 1 = YES 2 = On USF fault (if tCC = 2C)
W151	OPL		Motor phase loss.	0 = nO 1 = YES
W152	IPL		Line supply phase loss.	0 = nO 1 = YES
W155	FLr		Catch a spinning load.	0 = nO 1 = YES
W156	StP		Controlled stop when line supply is lost.	0 = nO 1 = YES
W190	drn		Downgrade operation if line supply drops below 40%.	0 = nO 1 = YES

Adjustment Parameters

These parameters can be adjusted with the motor stopped or running.

Table 18: Adjustment Parameters

Word	Code	Units	Description	Possible Values or Range
W250	HSP	0.1 Hz	High speed.	LSP to tFr
W251	LSP	0.1 Hz	Low speed.	0 to HSP
W252	ACC	0.1 s	Acceleration (the time between 0 and 50/60 Hz).	0 = Ramp 0.05 s (special case) 1 to 36000 = Ramp 0.1 to 3600 s
W253	dEC	0.1 s	Deceleration (the time between 50/60 and 0 Hz).	0 = Ramp 0.05 s (special case) 1 to 36000 = Ramp 0.1 to 3600 s
W254	UFr	1%	IR compensation.	0 to 100
W255	FLG	1%	Frequency loop gain.	0 to 100
W258	ItH	0.1 A	Thermal protection current.	0.5 x INV to 1.15 x INV, where INV is the nominal current of the drive controller
W259	SLP	0.1 Hz	Slip compensation.	0 to 50
W260	AC2	0.1 s	Acceleration 2 (the time between 0 and 50/60 Hz).	0 = Ramp 0.05 s (special case) 1 to 36000 = Ramp 0.1 to 3600 s
W261	dE2	0.1 s	Deceleration 2 (the time between 50/60 and 0 Hz).	0 = Ramp 0.05 s (special case) 1 to 36000 = Ramp 0.1 to 3600 s
W262	JOG	0.1 Hz	Jog frequency (jog operation).	0 to 100
W264	SP2	0.1 Hz	Preset speed 2.	LSP to HSP
W265	SP3	0.1 Hz	Preset speed 3.	LSP to HSP

ENGLISH

Table 18: Adjustment Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W266	SP4	0.1 Hz	Preset speed 4.	LSP to HSP
W267	SP5	0.1 Hz	Preset speed 5.	LSP to HSP
W268	SP6	0.1 Hz	Preset speed 6.	LSP to HSP
W269	SP7	0.1 Hz	Preset speed 7.	LSP to HSP
W270	IdC	0.1A	Injection current.	0.1 ItH to INV, where INV is the nominal current of the drive controller
W271	tdC	0.1 s	Injection time (when automatic injection on stopping enabled).	0 to 254 = time (0.0 s to 25.4 s) 255 = CONT (continuous injection)
W272	tLS	0.1 s	Maximum time at low speed (LSP).	0 = NO (no limit) 1 to 255 = time (0.1 s to 25.5 s)
W279	rPG	0.01	PI proportional gain.	1 to 10000 (gain from 0.01 to 100.00)
W280	rIG	0.01/s	PI integral gain.	1 to 10000 (gain from 0.01/s to 100.00/s)
W281	FbS	0.1	PI feedback scale factor.	1 to 1000 (factor 0.1 to 100.0)
W282	Ctd	0.1 A	Current threshold reached.	0.1 x INV to 1.5 x INV, where INV is the nominal current of the drive controller
W283	ttd	1%	Thermal threshold reached.	1 to 118
W284	Ftd	0.1 Hz	Frequency threshold reached.	0 to HSP
W286	JPF	0.1 Hz	Skip frequency on a frequency range of ±1 Hz around the adjusted value.	0 to HSP
W287	PIC	–	Reversal of direction of correction of PI regulator.	0 = nO 1 = YES
W340	rOt	–	Control of operating direction with local control option. This parameter is only accessible in Read mode.	0 = FOr (Forward) 1 = rrS (Reverse)

ENGLISH

CONTROL PARAMETERS (READ AND WRITE)

⚠ WARNING

UNINTENDED EQUIPMENT ACTION

- Writing to registers designated as reserved can cause unintended equipment operation.
- DO NOT write data to registers unless you completely understand the function to be performed. Consult the user instruction bulletin for additional details.
- Bit 0 is the right-most (least significant) bit. Bit 15 is the left-most (most significant) bit.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Table 19: ATV28 and MODICON™ PLC Register Mapping

ATV28 Drive Controller	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
QUANTUM™ PLC [1]	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

1. For MOMENTUM™ PLCs, consult the MODICON MOMENTUM user's manual.

Table 20: Control Parameters

Word	Code	Units	Description	Possible Values or Range
W400	CMD	–	DRIVECOM control parameter. Parameter is reinitialized at the end of time-out unless bit 14 of CMI (W402) is set to 1.	Bit 0 = 0 and Bit 15 = 0: Not ready Bit 1 = 1 and Bit 15 = 0: Ready Bit 1 = 0: Return to Switch ON disabled status Bit 1 = 1: No action Bit 2 = 0 and Bit 15 = 0: Fast stop Bit 2 = 1: No action Bit 3 = 0 and Bit 15 = 0: DRIVECOM stop command Bit 3 = 1 and Bit 15 = 0: DRIVECOM run command Bits 4 to 6: Reserved Bit 7 = 0: No action Bit 7 = 1: Reset faults Bit 8 = 0 and Bit 15 = 1: Activate control via serial link Bit 8 = 1 and Bit 15 = 1: Deactivate control via serial link Bits 9 and 10: Reserved Bit 11 = 0: Normal direction command Bit 11 = 1: Reverse direction command Bit 12 = 0: Motor run command (RUN) Bit 12 = 1: Motor stop command Bit 13 = 0: No action Bit 13 = 1: Stop by DC injection command Bit 14 = 0: No action Bit 14 = 1: Fast stop command Bit 15 = 0: DRIVECOM standard control Bit 15 = 1: ATV28 drive control
W401	LFR	0.1 Hz	Frequency reference in line mode (signed in two's complement). Parameter is reinitialized at the end of time-out unless bit 14 of CMI (W402) is set to 1.	LSP to HSP

Table 20: Control Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W402	CMI	–	Internal control register (application program). Parameter is reinitialized at the end of time-out unless bit 14 is set to 1. Note that each action of bits 0, 1, and 2 is only accepted if the motor is stopped and the drive controller powered up without a USF fault. When accepted, W402 interrupts communication while it executes (for a duration of no more than 2 seconds). The PLC time out must therefore be set to a higher value to avoid tripping during execution. While execution is in process, the display of the drive indicates: • INIT (for bits 0 and 2) • NENO (for bit 1) If several of these bits are active simultaneously, bit 0 has priority over bits 1 and 2, while bit 1 has priority over bit 2.	Bit 0 = 0: No action Bit 0 = 1: Return to factory settings; this bit automatically resets to 0 after accepting the request. Bit 1 = 0: No action Bit 1 = 1: Save configuration/adjustments that were the objects of a write request in EEPROM. This bit automatically resets to 0 after accepting the request. Bit 2 = 0: No action Bit 2 = 1: Return to values memorized in EEPROM (cancel write operations). This bit automatically resets to 0 after accepting the request. Bit 3 = Reserved Bit 4 = 0: No action Bit 4 = 1: Ramp switching command Bits 5 to 12: Reserved Bit 13 = 0: Drive controller not locked at stop Bit 13 = 1: Drive controller locked at stop Bit 14 (NTO) = 0: Detection of communication loss Bit 14 (NTO) = 1: No detection of communication loss (do not use this value until you have read the Warning on page 26 of this manual) Bit 15 = Reserved
W440	rPI	0.1%	PI regulator internal setpoint (if AIC/AI2 [W107] = PII)	0 to 1,000

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MONITORING PARAMETERS

These parameters are read-only except for outputs if they are not assigned.

Table 21: Monitoring Parameters

Word	Code	Units	Description	Possible Values or Range
W450	FrH	0.1 Hz	Frequency reference (absolute value).	Value read
W451	rFr	0.1 Hz	Output frequency applied to the motor (absolute value).	Value read
W452	SPd	RPM	Motor speed estimated by drive controller (absolute value).	Value read
W453	LCr	0.1 A	Current in motor.	Value read
W454	ULn	0.1 V	Line voltage (from bus).	Value read
W455	tHr	1%	Motor thermal state (100% = nominal thermal state, 118% = OLF threshold).	Value read
W456	tHd	1%	Drive controller thermal state (100% = nominal thermal state, 118% = OHF threshold).	Value read
W457	LFt		Last fault.	0 = nOF (No fault memorized) 1 = InF (Internal fault) 2 = EEF (EEPROM memory fault) 5 = SLF (Serial link fault [link break]) 9 = OCF (Overcurrent fault) 16 = OHF (Drive overheating fault [on heatsink])) 17 = OLF (Motor overload fault) 18 = ObF (DC bus overvoltage fault) 19 = OSF (Line supply overvoltage fault) 20 = OPF (Motor phase failure fault) 21 = PHF (Line supply phase failure fault) 23 = SCF (Motor short-circuit fault [phase, earth]) 25 = tnF (Autotuning fault)

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Table 21: Monitoring Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W458	ETA	–	DRIVECOM drive controller status register	Bit 0= 0: AC line power present. Drive controller not ready Bit 0= 1: AC line power present. Drive controller ready Bit 1 = 0: Drive not ready Bit 1 = 1: Drive ready (rdY) Bit 2 = 0: DRIVECOM stop Bit 2 = 1: DRIVECOM run Bit 3 = 0: Fault absent Bit 3 = 1: Fault present (FAI) Bit 4 = 0: AC line power present Bit 4 = 1: AC line power absent Bit 5 = 0: Fast stop in progress Bit 5 = 1: Fast stop absent Bit 6 = 0: Controller stop. Catch a spinning load possible Bit 6 = 1: Freewheel stop. Catch a spinning load not possible Bit 7 = 0: Motor or drive thermal alarm absent Bit 7 = 1: Motor or drive thermal alarm present Bit 8: Reserved Bit 9 = 0: Forced local in progress (FLO) Bit 9 = 1: Forced local absent Bit 10 = 0: Reference not reached (transient state) Bit 10 = 1: Reference reached (steady state) Bit 11 = 0: Last commanded speed reference normal Bit 11 = 1: Last commanded speed reference exceeded (either greater than HSP or less than LSP) Bits 12 and 13: Reserved Bit 14 = 0: No stop by STOP key (remote keypad) Bit 14 = 1: Stop by STOP key (remote keypad) Bit 15 = 0: Forward rotation (output frequency) Bit 15 = 1: Reverse rotation (output frequency)

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Table 21: Monitoring Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W459	ETI	–	Drive controller internal status register number 1	Bits 0 to 3: Reserved Bit 4 = 0: Motor stopped Bit 4 = 1: Motor running Bit 5 = 0: No DC injection Bit 5 = 1: DC injection Bit 6 = 0: Drive controller in steady state Bit 6 = 1: Drive controller in transient state Bit 7 = 0: No thermal overload alarm Bit 7 = 1: Thermal overload alarm Bit 8 = 0: No alarm if excessive braking Bit 8 = 1: Alarm if excessive braking Bits 9 and 10: Reserved Bit 11 = 0: No current limit alarm Bit 11 = 1: Current limit alarm Bit 12: Reserved Bit 13=0 and Bit 14=0: Drive controlled via terminals Bit 13=0 and Bit 14=1: Serial link controls drive Bit 13=1 and Bit 14= 0: Remote keypad controls drive Bit 15 = 0: Forward rotation requested (reference) Bit 15 = 1: Reverse rotation requested (reference)
W460	ETI2	–	Drive controller internal status register number 2	Bits 0 to 3: Reserved Bit 4 = 0: Speed reference not reached Bit 4 = 1: Speed reference reached Bit 5 = 0: Frequency threshold (Ftd) not reached Bit 5 = 1: Frequency threshold (Ftd) reached Bit 6 = 0: Current threshold (Ctd) not reached Bit 6 = 1: Current threshold (Ctd) reached Bits 7 to 15: Reserved
W461	ETI3	–	Drive controller internal status register number 3	Reserved

Table 21: Monitoring Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W462	DP1	–	Past fault number 1. Current or most recent fault.	0 = nOF (No fault memorized) 1 = InF (Internal fault) 2 = EEF (EEPROM memory fault) 5 = SLF (Serial link fault [link break]) 9 = OCF (Overcurrent fault) 16 = OHF (Drive overheating fault [on heatsink])) 17 = OLF (Motor overload fault) 18 = ObF (DC bus overvoltage fault) 19 = OSF (Line supply overvoltage fault) 20 = OPF (Motor phase failure fault) 21 = PHF (Line supply phase failure fault [> 1 s]) 23 = SCF (Motor short-circuit fault [phase, ground]) 25 = tnF (Autotuning fault)
W464	DP2	–	Past fault number 2.	Same as DP1 (W462)
W466	DP3	–	Past fault number 3.	Same as DP1 (W462)
W468	DP4	–	Past fault number 4.	Same as DP1 (W462)
W478	IOLR	–	Image of logic I/O.	Bit 0 = Image of logic input LI1 (active at 1) Bit 1 = Image of logic input LI2 (active at 1) Bit 2 = Image of logic input LI3 (active at 1) Bit 3 = Image of logic input LI4 (active at 1) Bits 4 to 7: Reserved Bit 8 = Image of relay R1 (active at 1) Bit 9 = Image of relay R2 (active at 1) Bits 10 to 15: Reserved
W479	AI1R	0.001 V	Image of analog input AI1 (actual size calibrated and scaled).	Value read
W480	AI2R	0.001 mA	Image of analog input AIC/AI2 (actual size calibrated and scaled).	Value read
W482	AOR	0.001 mA	Image of analog output AO.	Write (authorized if AO = nO): 0 to 20000 Read (only if AO is assigned): Value read
W483	DF1	–	Register of active faults 1 (no fault if bits = 0).	Bit 0 = 1: Incorrect calibration constants (InF) Bit 1 = 1: Unknown drive controller rating (InF) Bit 2 = 1: Unknown/incompatible hardware (InF) Bit 3 = 1: Control card EEPROM fault (EEF) Bits 4 to 7: Reserved Bit 8 = 1: Serial link fault (SLF) Bits 9 to 12: Reserved Bit 13 = 1: Motor short-circuit (SCF) Bits 14 and 15: Reserved
W484	DF2	–	Register of active faults 2 (no fault if bits = 0).	Bits 0 to 2: Reserved Bit 3 = 1: Overcurrent fault (OCF) Bits 4 to 6: Reserved Bit 7 = 1: Drive controller overheating fault (OHF) Bit 8 = 1: Motor overload fault (OLF) Bit 9: Reserved Bit 10 = 1: DC bus overvoltage fault (ObF) Bit 11 = 1: Line supply overvoltage fault (OSF) Bit 12 = 1: Motor phase failure fault (OPF) Bit 13 = 1: Line supply phase failure fault (PHF) Bit 14 = 1: Line supply undervoltage fault (USF) Bit 15 = 1: Control card power supply fault (InF)

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Table 21: Monitoring Parameters (Continued)

Word	Code	Units	Description	Possible Values or Range
W487	OLO	1%	Motor torque.	Value read (100% = nominal motor torque)
W491	OPr	1%	Output power.	Value read (100% = nominal motor power)
W530	TIM	1 H	Cumulative operating time in hours.	Value read
W551	CPU	–	Firmware version of drive controller.	Bits 0 to 7: hexadecimal upgrade index Bits 8 to 15: firmware version in hexadecimal format
W552	NCV	–	Drive controller power rating.	4 = U09 5 = U18 6 = U29 7 = U41 8 = U54 10 = U72 11 = U90 12 = D12 13 = D16 14 = D23
W553	VCAL	–	Drive controller voltage rating.	1 = Single-phase 200/240 V 2 = Three-phase 380/500 V 3 = Three-phase 200/230 V
W555	INV	0.1 A	Drive controller nominal current.	Value read

SPECIAL DRIVECOM PARAMETERS (READ AND WRITE)

Table 22 describes the special DRIVECOM parameters, W600 to W615. Note that the use of parameters W603 to W615 necessitates a special configuration of parameter SdS (W41), which is found in drive parameter menu drC-. This parameter enables the drive controller to establish the relationship between the frequency in Hz and the speed in revolutions/minute.

The value of parameter SdS is 60/p, where p is the number of pairs of poles in the motor. For example, if motor rpm is 1750 at 60 Hz and the motor has four poles, SdS = 30 (60 divided by 2 pole pairs).

Table 22: Special DRIVECOM Parameters

Word	Code	Units	Description	Possible Values or Range
W600	ERRD	–	Error code (603FH), write-protected.	0 = nOF (No fault) 1000H = OLF (Motor overload fault) 2310H = OCF (Overcurrent fault) 3110H = OSF (Line supply overvoltage fault) 3120H = USF (Line supply undervoltage fault) 3130H = PHF (Line supply phase failure fault) 3310H = ObF or OPF (DC bus overvoltage fault or motor phase failure fault) 4210H = OHF (drive controller overheating fault) 5520H = EEF (EEPROM memory fault) 6100H = InF (Internal fault) 7510H = SLF (Serial link fault)
W601	CMDD	–	Control word (same as parameter CMD [W400]).	
W602	ETAD	–	Status word (same as parameter ETA [W458]), write-protected.	
W603	LFRD	1 rpm	Speed reference (reference not peak limited).	–32768 to +32768
W604	FRHD	1 rpm	Ramp output signed, write-protected.	–32768 to +32768
W605	RFRD	1 rpm	Motor speed, write-protected.	0 to 65535
W606	SMIL	1 rpm	Low speed, equivalent to LSP (W251), but in rpm.	0 to (HSP x SdS)
W607	SMIH	–	Reserved.	0
W608	SMAL	1 rpm	High speed, equivalent to HSP (W250), but in rpm.	(LSP x Sds) to (tFr x SdS)
W609	SMAH	–	Reserved	0
W610	SPAL	1 rpm	Speed for calculating the acceleration ramp.	1 to 65535
W611	SPAH	–	Reserved.	0
W612	SPAT	1 s	Time for calculating the acceleration ramp (the time to go from 0 to SPAL [W610]).	0 to 65535
W613	SPDL	1 rpm	Speed for calculating the deceleration ramp.	1 to 65535
W614	SPDH	–	Reserved.	0
W615	SPDT	1 s	Time for calculating the deceleration ramp (the time to go from SPDL [W613] to 0).	0 to 65535

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